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RESEARCH ARTICLE

FLORISTIC AND ETHNOBOTANICAL STUDIES OF THREE PLANTS, CACTUS, CAROB AND CAPER USED IN THE ZERHOUN REGION (MOROCCO)

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ABSTRACT

The aim of this research project was to provide a thorough and comprehensive analysis of ethnobotanical and floristic investigations of medicinal and food-based plants. The study was based on a collection of data on food and therapeutical uses among the people of Zerhoun area. A series of ethnobotanical surveys were carried out in the field for three months long (from April to June 2014). The research endeavoured up by the identification of samples in the field and in the laboratory. Scrutiny of these samples resulted in identifying three species: Cactus (*Opuntia ficus indica* L. Mill.), Carob (*Ceratonia siliqua* L.) and Caper (*Capparis spinosa* L.). Using computer processing, the results showed that the most used plants in the region were found to be: the Cactus, then Carob and finally the Caper. These plants are famous as food plants, therapeutic and commercial advantages.

INTRODUCTION

Medicinal plants are a precious heritage for humanity, especially for the majority of poor communities in the developing countries in the absence of modern medical systems (Tabuti *et al.*, 2003) that depend for their primary health care and their subsistence. These communities make use of many plant species, both woody and herbaceous, as medicines. A well-held belief is that any plant treats a certain disease. According to the World Health Organization, more than 80% of the African population resort to herbal medicine and traditional medicine to deal with health problems. The African continent is full of very diverse medicinal plants. Practically, out of the 500,000 plant species recorded on the planet more than 80,000 species have medicinal properties (Quyou, 2003).

Morocco also is considered to be rich and diverse in its flora. It is a real phylogenetic tank (Scherrer *et al.*, 2005) but the medicinal species do not extend 356 species in total (Hmamouchi *et al.*, 1993) and 600 species (Rejdali, 1996) is 8.69%, respectively and 14.28% of Morocco's total flora. However, lately several countries, including Morocco has, for over a quarter century severed drought which has had harmful effects on agriculture and the economy of these countries. This drought issue has become a structural fact which requires the adaptation of agriculture to become less dependent on the climate changes.

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This is one of the objectives of the concept of integrated and sustainable development set by the United Nations (UNDP, 2008) in collaboration with FAO which aims at increasing agricultural potential of these arid areas. Among the crop species resistant to water stress tolerant to poor soils are cactus, carob, and caper. Indeed these plants' "miracle" allowed the development of marginal land in arid and semi-arid areas that were not previously cultivated. Adaptation to different climates and soils allowed the plant to respond effectively when used in the fight against erosion and regeneration of natural species (Jan L. Beyers, 2004). They also have a highly efficient biomass production. Intensive plantations have emerged in recent years in Morocco, especially in the Zerhoun area, and a very high genetic variability has been created within the cactus, carob and Moroccan caper. This variability could thus be considered as an additional economic wealth which necessitates more consideration and attention to line with countries such as Mexico, Italy, Spain, South Africa, Tunisia, etc.

Especially since these crops are prodigious, this remarkable extension and its integration into development programs should be accompanied by a reflection on the possibilities of its transformation to diversify market opportunities and enhance production. The development of new opportunities outside the traditional classified derivatives are therefore of increasing importance especially for its fruit "prickly pear" "the caper" "carob". The present ethnobotanical research on medicinal and food plants was applied in the Zerhoun area of Fes- Meknes Region (Morocco). This zone offers a floristic and ecological diversity that should be profoundly studied to be properly

exploited, hence the need for a research project rises to document this endeavour and enrich increase scientific research. This ethnobotany, floristic work, is believed to fit into the requirements of this framework, wherein the current research project focuses on food recovery, non-food and pharmaceutical cladodes, seeds and fruits of the prickly pear cactus and carob trees and caper area Zerhoun in collaboration with the social development agency.

Geographic and Socio-Economic Context of the Study Area

The Zerhoun area is located north west of Morocco and covers a geographical area of approximately 636 km²(Fig1) (Wilaya census, 2008). It is limited on the west side by the province of MoulayYacoub, on the east by the rural communes of OuedRomman and Dar OumSoltane, on the north by the province SidiKacem and on the south by the rural commune of El Mhaya, the rural commune of OuedJdida, the rural commune of Ouislane and the urban commune of Meknes. Figure 2 shows the names and the surfaces of the communes composing the zone studied.

the influence of agriculture is paradoxically lower in mountain areas than elsewhere in Zerhoun. This situation is explained by the higher proportion of arid and semi-arid but this finding must be qualified by the lack of consideration of sustainable development strategies. Mountain areas are primarily rural areas characterized by a lower population density than the average Zerhoun area, but with some nuances between massifs. The Massive North consists predominantly of rural and poorer areas, where the population density is low and the share of agriculture in employment is important. It is primarily based on the age-old olive cultivation and cereal (DPA, 2012). The population is mostly Arabic speaking, unlike some neighbouring villages with Rif's minorities whose mother tongue is Amazigh. The population is predominantly young. The area suffered the brunt of the economic crisis, drought and unemployment, as is the case throughout the region (Wilaya census, 2008). The climate of the Zerhoun area is semi-arid undergoing continental influences. This translates into a high temperature range. The maximum average temperatures between spring and autumn ranges from 14 °C to 20 °C, while the average minimum temperatures ranges from 5°C to 14°C.

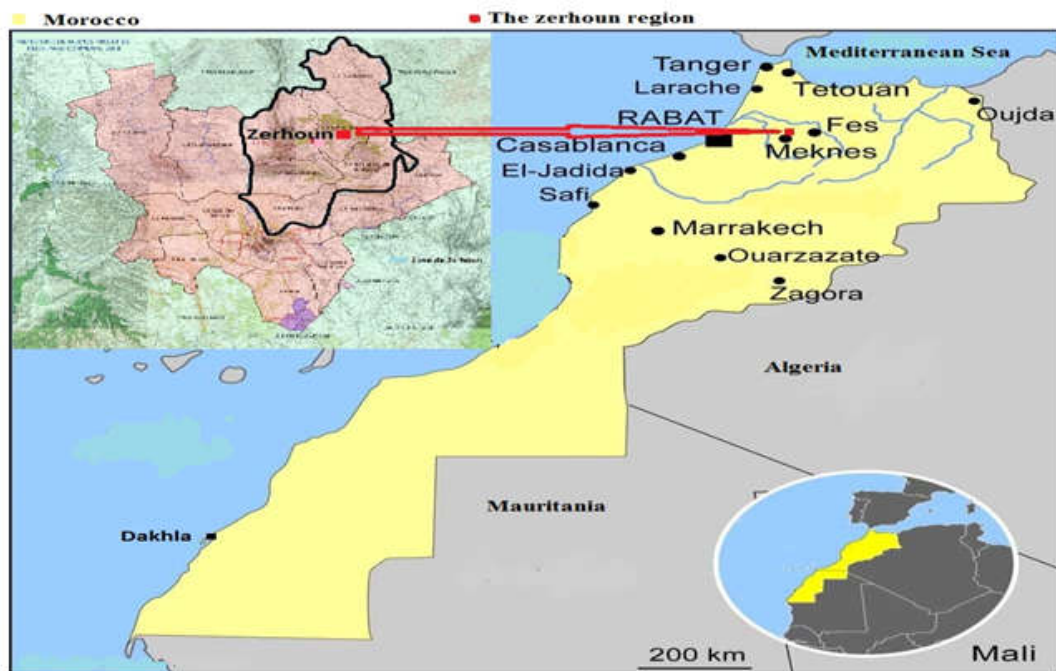
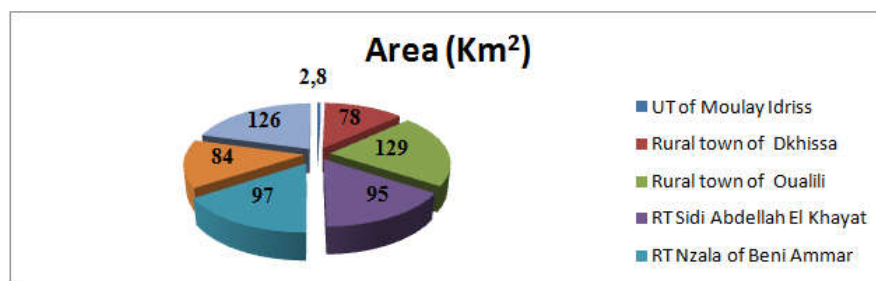


Fig. 1. Location of the Zerhoun area in the map of Morocco



*RT: Rural Town, UT: Urban Town

Fig. 2. Administrative division of the Zerhoun zone areas (Wilaya census, 2008)

Data from the observatory of territories of Zerhoun Mountains was used to draw a general overview of mountain areas in the study region and account for some diversity between the massifs in terms of socio-economic dynamics and weight of agriculture. Given the percentage of land in agricultural area,

The average maximum temperatures in summer rise to 42°C. Finally, winter is relatively cold. In December, January and February, the minimum and maximum average temperatures are respectively 2°C and 11°C (DRA, 2010). The area takes its name from the city, built on ZerhounMount by MoulayIdriss I,

who founded the first Islamic state in Morocco, in the late seventh century. It is of a spiritual nature that allowed the establishment of several monuments and religious shrines with the most important being the mausoleum MoulayIdriss.

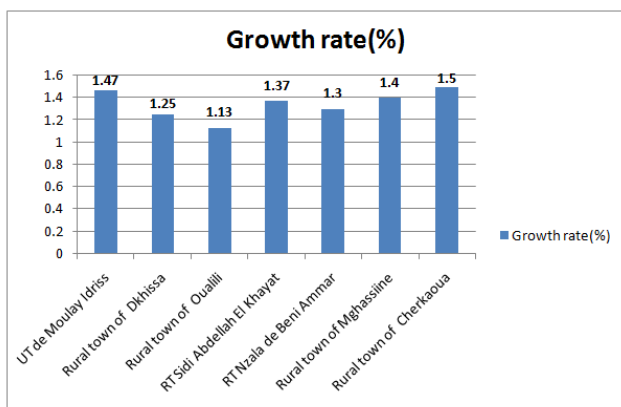
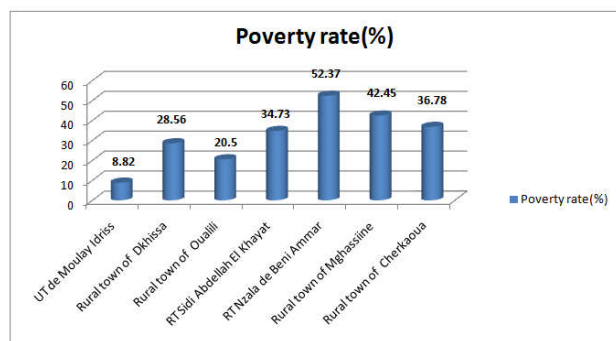


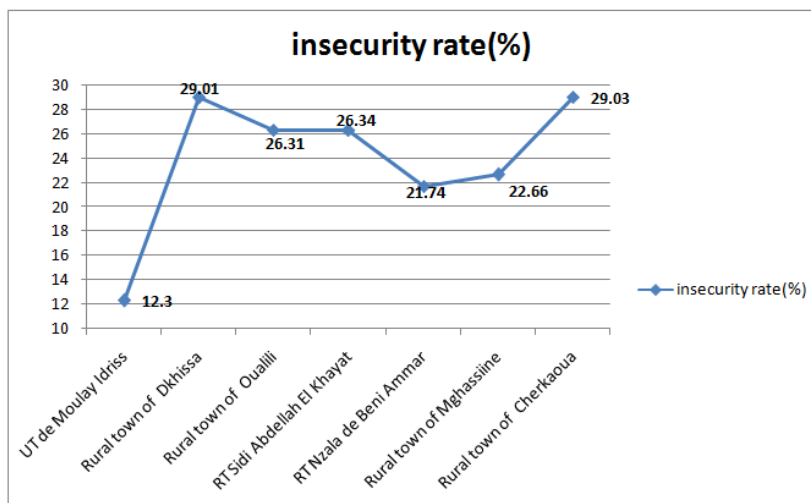
Fig. 3. Growth rate of the population of the area Zerhoun (Wilaya census, 2008)

The city is characterized by Islamic architecture developed and designed and perfectly integrated with the local cultural environment style. Also of note, the Roman city i.e. Oualili which lies near the city of MoulayIdriss, Zerhoun (Wilaya, census, 2008) The population growth rate in the Zerhoun area (Fig. 3) is increasing because the rate of natural increase (difference between the birth rate and the death rate) is growing rapidly. A trend that now affects all developing countries.



RT: Rural Town, UT: Urban Town

Fig. 4. Population poverty rate in the area of Zerhoun (Wilaya census, 2008)



RT: Rural Town, UT: Urban Town

Fig. 5. Insecurity rate of the population in the area of Zerhoun (Wilaya census, 2008)

According to this graph (Fig4), the majority of the rural population lives below the poverty line. Children are the most affected by the delay of the rural world both in terms of health, education and personal development. Unemployment and aging constitutes a major source of insecurity in Zerhoun (Fig 5), particularly for women and young people, given the importance of the informal sector and low coverage of social protection combined with physical degradation under the weight of age (HCP, 2004). Cooperatives are the only industrial structures that are in the Zerhoun area, and have a commitment to their communities. They contribute to the sustainable development of their territories and their communities by empowering people locally, to engage in economic activity generating income that is spent locally, building on the resources and local know how and setting up activities production that are environmentally friendly. Zerhoun cooperatives are associated with great expectations. They have a potential for accelerated growth and development.

Sampling

Using 280 question cards, ethnobotanical field investigations were carried out for three months from April to June 2014. The location of the different environments of ethnobotanical and floristic surveys in the study area was identified by "probabilistic stratified" sampling techniques (Kahouadji, 1986). In this work, the sample is divided into seven strata; six correspond to the numbers of the rural communes of Zerhoun area and an urban municipality of MoulayDrissZerhoun (Table 1). Proceeding by simple random sampling, samples of small numbers (40 people) are then formed for each of the seven strata and they are put together to form the aggregate sample (280 people). This study aims at first to collect the medicinal uses of the three plants, then to get an idea on their economic and nutritional importance on the population.

Research tool used

The time devoted to each interview was approximately 20 minutes to an hour. During each interview with the respondent, we collected all the information on the three medicinal and food plants used by them. Thus, from the sampled variables, including gender, academic level, age and place of residence of the study area, we were able to characterize the population of the circle.

Table 1. Distribution of investigations based on strata

Strata	Name of strata	Number of investigations
Strate 1	MoulayDrissZerhoun	40
Strate 2	Charkaoua	40
Strate 3	N'zalatBni Ammar	40
Strate 4	Oualili	40
Strate 5	Mghassiyine	40
Strate 6	Sidi Abdallah Al khayat	40
Strate 7	Dkhissa	40
		Total Samples:280

The data collected for each plant includes the common local name, type (wild, cultivated), plant uses, parts used, methods of preparation and collection period.

Determining the scientific nomenclature was performed on the species, with the following documents:

- Morocco's medicinal plants (Sijlmassi, 1993);
- The traditional Moroccan pharmacopoeia (Bellakhdar, 1997);
- Moroccan medicinal and aromatic plants (Hmamouchi, 2001);
- Vascular flora of Morocco: inventory and chorology (Fennaneet *al.*, 2005).

Statistical analysis

Processing results were performed by Excel 2007 software.

RESULTS AND DISCUSSION

The results obtained in the ethnobotanical survey, conducted among respondents in the Massif of Zerhoun, are combined and disclosed as follows:

- Anthropological data (gender, age), cultural (academic) and sociological (housing, family status);
- Data on the disease and traditional medicine: diseases treated by these plants;
- Data on plant used: the common local name, scientific name, uses, parts used, mode of preparation and administration, method of use, dose used, utilization percentage of each plant by area study.
- Sources of information on the use of medicinal plants, health outcomes, field of use of the test plants.

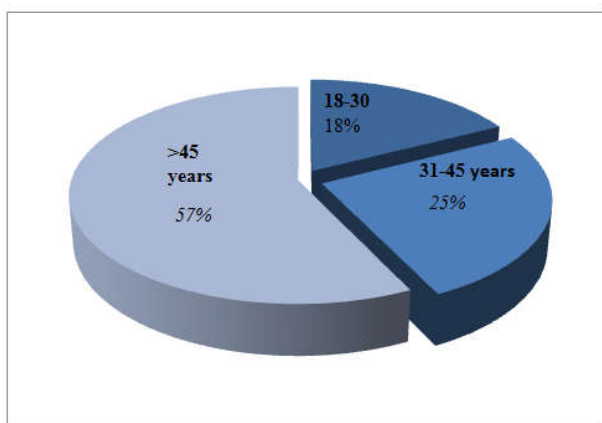


Fig. 6. Distribution of users of the plants studied by age

Use of medicinal plants by age

The use of medicinal plants studied in the massif Zerhoun is prevalent among all age groups, predominantly (Fig 6) in the older group over 45 years (57%). However, for the age group 31 to 44 years, we note a rate of 25% and for young people aged 18 to 30 years (18%), the use of the three plants does not represent a great therapeutic interest, but a food and commercial interest. Several factors could explain this result indeed; knowledge of the properties and uses of medicinal plants generally is vested after a long accumulated experience and passed from one generation to another. The transmission of this knowledge is in danger now because it is not always assured (Anyinam, 1995). The results do show that people who belong to the age group above 45 years old have more knowledge of medicinal and food plants compared to other age groups. The experience cumulated with age is locally the main source of information about the use of traditional medicinal plants. During this study a loss of information on medicinal plants was noticed, which explains the mistrust of some people, especially young people, who tend not to believe too much in these traditional medicines.

Use of medicinal plants by sex

The results obtained show the use of the three plants varies by gender (Fig7). Women use more herbs than men. Indeed, of those surveyed 126 men (45%) use traditional medicine against 154 women (55%). This could be explained by the use of medicinal plants by women in other areas than therapy and their responsibility as mothers, it is they who give first aid especially to their children. These results confirm other ethnobotanical fieldwork nationwide, case work Mehdioui & Kahouadji, 2007 (Mehdioui *et al.*, 2007) in the forest Amsitène (Province of Essaouira) they have shown that women are more holders of knowledge traditional herbal.

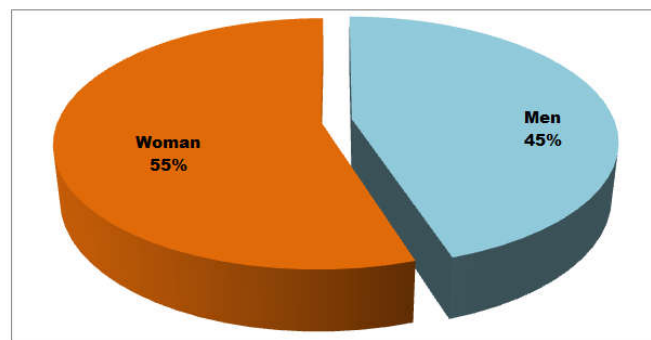


Fig. 7. Distribution of the plantsusers studied by sex

Use of medicinal plants according to the academic level

Of all the users of traditional medicine the illiterate dominate with a percentage of 45% (Fig 8). However, those with a primary level of education have a significant percentage of use (31% primary), while those with a college level, secondary, university use less medicinal plants (11% respectively 8%, 5%).

Use of medicinal plants by family situation

The studied medicinal plants are much used by married people (Fig 9) with a percentage 80% as singles (20%), because they

allow them to avoid or minimize costs required by the physician and the pharmacist.

consumption of fruits but also by the presence of caper cooperatives and prickly pear in this region exporting its fruits.

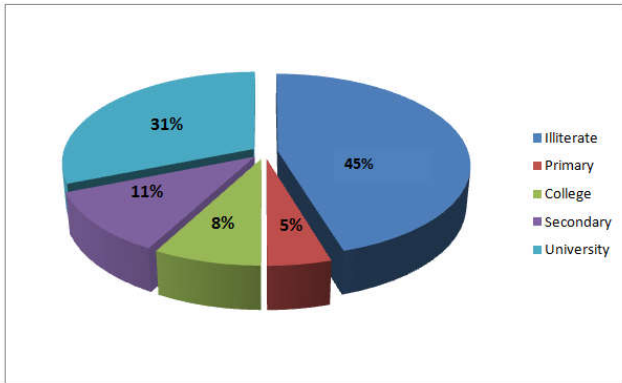


Fig. 8. Distribution of users of the plants studied on the academic level

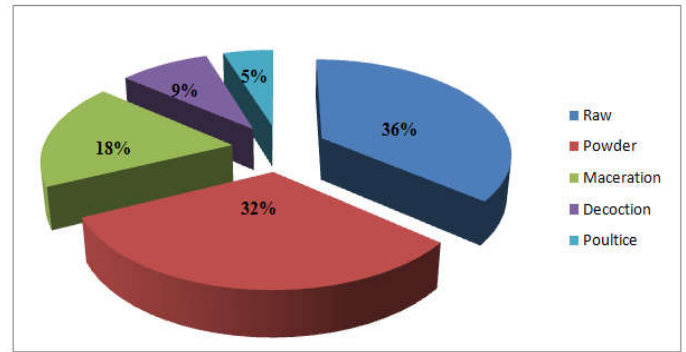


Fig. 11. Distribution mode of preparation of the plants studied

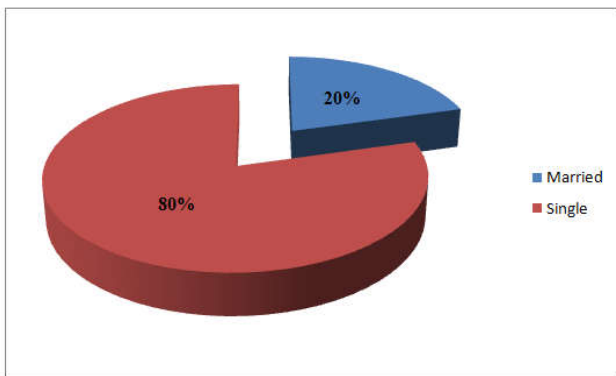


Fig. 9. Distribution of the plants users studied by Family

Use of medicinal plants in the care of diseases

Parts used

A total of 5 parts of plants are used in traditional medicine in particular the seed, roots, whole plant, stem, leaf, flower, and fruit. The percentage of use of these parts (Fig10) shows that the fruit and flower are used the most (65.32%) and (20.71%).

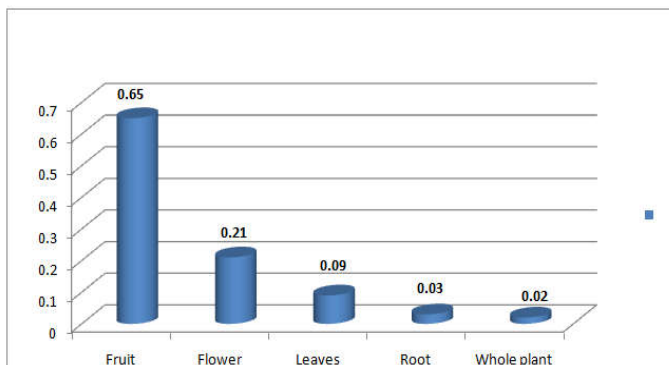


Fig. 10. Representation of the percentages of parts used

The leaves and root are in second and third place with a percent 8.52% and 3.18%, respectively. The whole plant is introduced with a rate of (2.27%) The fruit high frequency of use due to the ease and speed harvesting, they are known to the usual

Method of preparation

To facilitate the administration of the active principle, several methods are used namely infusion, decoction, poultice, powder, raw and cooked. Raw and powder are the two most used methods of preparation with a rate of 36% and 32% respectively (Fig 11).

Doses used

More than 74% of the users of the plants studied in the area of Zerhoun use medicinal plants with non-specific doses and 26% use precise dosages (Fig 12). The dose is still random which is manifested by adverse health effects because no substance is poison itself, it is the dose that makes the poison.

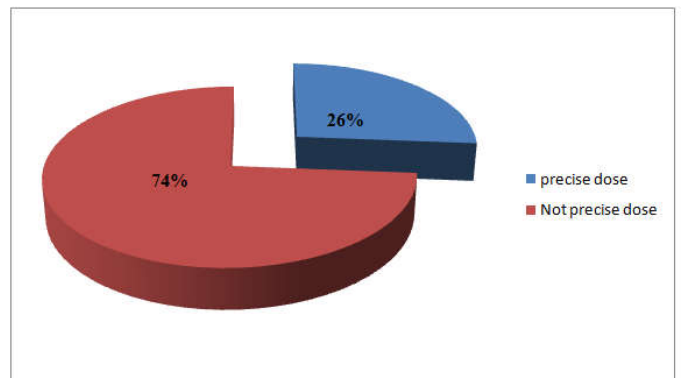


Fig. 12. Distribution of the plants users studied by dose used

Diseases and traditional medicine

This work, which contributes to a better understanding of traditional treatments practiced in the Region Zerhoun, allowed us to identify a number of chronic diseases treated with medicinal plants.

The results show that the three species recorded in the region are indicated in the treatment of the following: respiratory disorders (31%), digestive disorders (27%), musculoskeletal disorders (13%), dermatological conditions (11%), metabolic disorders (9%), and Kidney disorders and genitourinary diseases respectively 5%, 4% (Fig. 13).

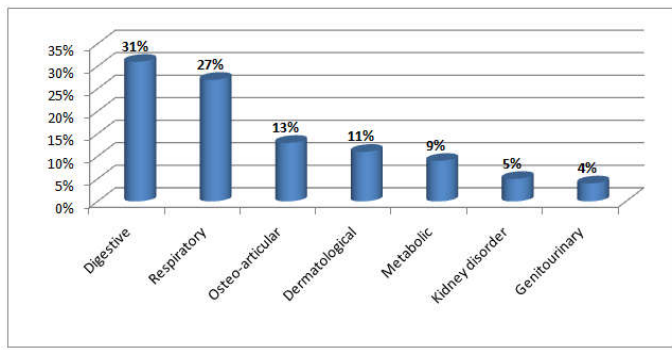


Fig. 13. Diseases treated by the plants studied

Care outcomes

During this study it was noted that 63% of the Zerhoun circle population think that medicinal plants allow improved health and 24% believe that medicinal plants allow healing of diseases treated, while 13% of the local population is that herbal remedies are ineffective against certain diseases, they can even cause poisoning (Fig 16).

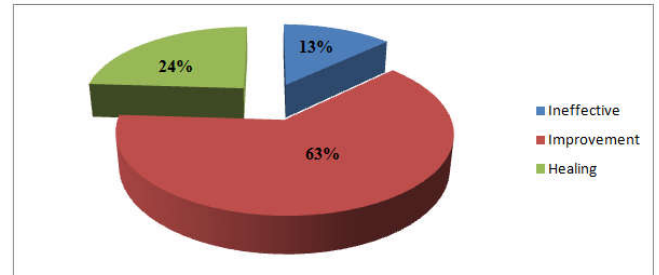


Fig. 16. Results of treatment of the diseases treated

Mode of administration of plants for the treatment of diseases

The results (Fig 14) show that more than 77% of users of medicinal plants in the circle of Zerhoun prefer the oral route, while 23 % of the surveyed population use these plants as massage against rheumatism and against hair loss.

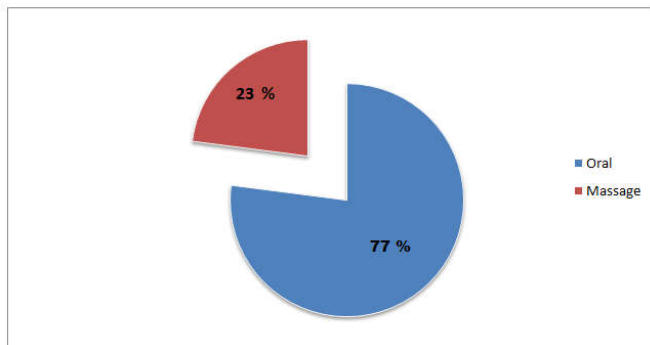


Fig. 14. Administration modes of plants

Utilization percentage of each plant according to the study area

Thanks to their geographical distribution cactus is the most used in the circle of Zerhoun (Fig 17) (44%) and carob (36%) and the caper (20%). However, we note that the caper and vegetable oil extracted from the prickly pear seeds have a greater economic and commercial importance, although planting carob is subsidized by the Moroccan government by means of Morocco Green Plan project

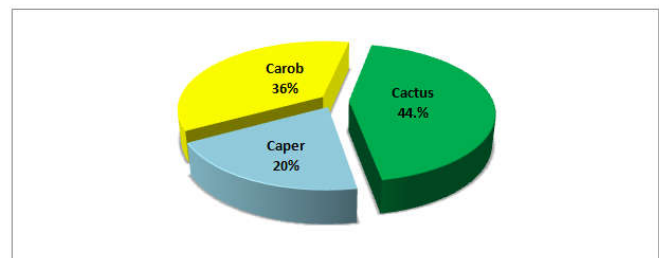


Fig. 17. The percentage of use of each plant

Source of information on the use of medicinal plants

We find that 71% of the population refers to the experiences of others to use herbs as remedies against well-defined diseases (Fig.15).

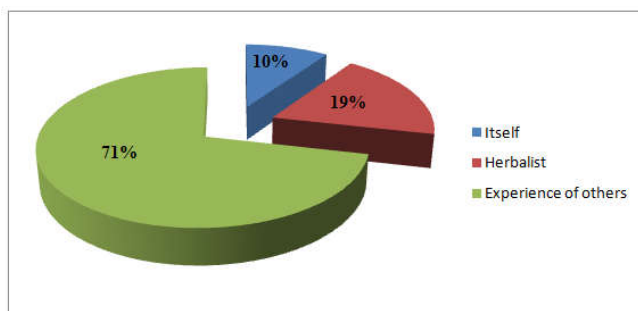


Fig. 15. Sources of information on the use of medicinal plants

This reflects the image of the relative transmission of traditional practices from one generation to another. Thus 19% of the population were referred to herbalists and 10% of those refer to their own knowledge or by following media programs, or based on their own experience with the existence of many medicinal plants in their surroundings.

Application areas

The economy of the Zerhoun area is based mainly on agriculture in rainfed and traditional breeding of livestock. The average level of poverty is of the order of 32.03%. This difficult economic situation encourages certain segments of the population to gather and market handcrafted three plants in the region (Fig 18).

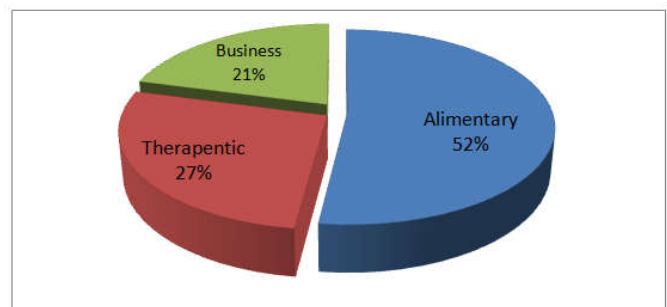


Fig. 18. The distribution of areas of use of the studied plants

Floristic Analysis

Based on 280 questionnaires carried out in the Circle of Zerhoun, ethnobotanics of seagrass has been developed and studied in the Institut Scientifique of Rabat (Morocco) under a botanist control, Dr. M. Ibn Tattou.

This ethnobotanical study is a source of information that contributes to a better knowledge of medicinal plants and a backup of the local folk knowledge. It can also be a database for the valuation of medicinal and food plants to discover new active ingredients used in pharmacology and food industry.



Fig. 19. Photos of the three species *Opuntia ficus-indica*, *Ceratonia siliqua* and *Capparis spinosa*

The floristic analysis of species recorded shows that the three species are used. They are divided into three genera and three botanical families and each one by a species. Of the three families of flora met, we have the following species: *Opuntia ficus-indica* L. Mill., *Ceratonia siliqua* L. and *Capparis spinosa* L. (Fig.19). The different species are represented as herbarium in which each species is characterized by a number of characters including the nomenclature, drugs, chemical composition, properties and local applications.

Conclusion

A medicinal plant are the first remedy for the population trust users and does not have the means to bear the consequences of modern medicine, not to mention the huge return to alternative medicine. Thus, this work is done in order to achieve the most complete investigation possible about three medicinal plants used in the Zerhoun region and to gather information about the food and therapeutic uses practiced in this area. The series of ethnobotanical surveys revealed a multitude of results. They show that:

The frequency of use of medicinal plants in the Circle of Zerhoun is closely linked to the profile of respondents. Thus, young, compared to the older generation, generally do not know the names or usefulness of most plant species. Women and men have shared medicinal knowledge, with a slight edge going to women;

Illiterates predominate with a rate of 43.36%;

- Fruit and flowers are the most used parts;
- Digestive disorders rank first, with a rate of 31%, followed by respiratory disorders with a rate of 27%.

In addition, these results allowed us to know the field of use of the three plants in traditional medicine which has three species in three genera of three families including the *Opuntia ficus-indica* L. Mill., *Ceratonia siliqua* L. and *Capparis spinosa* L.

Acknowledgement

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